Final Technical Report to Office of Naval Research

Project Title: Arctic Contamination Research and Assessment Program - Monitoring and Assessing Contaminants in Arctic Alaska

Principal Investigators:	Gunter Weller Patricia Anderson
Institution:	Center for Global Change and Arctic System Research Cooperative Institute for Arctic Research (CIFAR) University of Alaska Fairbanks
Address:	203 Eielson Building, P.O. Box 757740 Fairbanks, AK 99775-7740
Telephone:	(907) 474-7371 (907) 474-5698
E-mail:	gunter@gi.alaska.edu patricia@gi.alaska.edu

Grant Number:	NOOO14-94-1-1028
Grant Period:	15 July 1994 through 14 July 1997 (3 years)
Date Submitted:	3 December 1997

Please find enclosed seven copies of the final technical report, which includes:

1) Outer Continental Shelf Environmental Assessment Program (OCSEAP) Data Base, Shari George, Principal Investigator.
2) Environmental Monitoring, Glenn Shaw, Principal Investigator.
3) Persistent Organic Pollutant (POP's) Monitoring in Alaska, Dan Jaffe, Principal Investigator.
4) Native Student Involvement, John Kelley, Principal Investigator.

Outer Continental Shelf Environmental Assessment Program (OCSEAP) Database

Sharon W. George
PO Box 757320
University of Alaska, Fairbanks AK 99775-7320

Introduction

During the Arctic Environmental Reference Database Workshop (Arendal, Norway, September 1993) arranged by the US Geological Survey/Arctic Environmental Data Directory (USGS/AEDD) and the United Nations Environmental Program/Global Resource Information Database (UNEP/GRID), the needs arising from a "renaissance" in Arctic research were broadly discussed by an international community. Following a period characterized by restricted access to large parts of the Arctic, information on programs and institutions addressing environmental questions in the Arctic are essential. In addition, the parameters assessed and methodologies used including spatial and temporal coverage, related parameters with regard to specific measurements and information on where and how this information can be retrieved are required. Further, information on planned environmental assessment studies and information on existing programs in addition to environmental studies that have been carried out are key.

Local processes and events may have widespread geographic impact even as global processes may have significant effects locally. The potential effects of pollution threats from the long-range transportation of pollutants by the atmosphere, sea and rivers, the discharges and emissions from industries and the handling of radioactive matter are cause for great concern among circumpolar Arctic nations. The objectives of the international Arctic Monitoring and Assessment Program (AMAP) as well as the US Interagency Arctic Research Policy Committee (IARPC) also stress the importance of assessing current contamination and monitoring changes in the Arctic environment both ecologically and to humans.

As a step in addressing both the establishment of environmental/ecological conditions in Alaska twenty years ago and making earlier baseline data more accessible, we undertook a review of data collected under the Outer Continental Shelf Environmental Assessment Program (OCSEAP). This program was initiated by the US Department of Interior's Bureau of Land Management (now Minerals Management Service) and the US Department of Commerce's National Oceanic and Atmospheric Administration to ensure the protection of the marine and coastal environment from irreparable damage due to oil and gas exploration and development.

Objectives

During the decade between 1975 and 1985, OCSEAP funded many projects that fell under five general study elements:

- **Contamination Distribution**: Determination of the predevelopment distribution and concentration of contaminants commonly associated with oil and gas development.
- **Environmental Hazards**: Identification and estimation of the potential hazards posed by the environment to petroleum exploration and development.
- **Pollutant Transport, Weathering and Fate**: Determination of the ways in which contaminants would move through the environment and how they would be altered by physical, chemical, and biological processes.
- **Living Resources**: Determination and characterization of the biological populations, communities, and ecological systems that are subject to impact from petroleum exploration and development.
- **Effects**: Determination of the potential effects of contamination and other insults on living resources.

Given the potential of the OCSEAP results to provide valuable environmental and ecological data on the Alaskan portion of the Arctic, the objectives of this study were to:

- Re-discover much of the Arctic part of the OCSEAP documentation that now resides in the archives of the University of Alaska Fairbanks Rasmuson Library.
- Re-examine the data, major results and conclusions for current scientific use.
- Analyze the OCSEAP set for inclusion in an integrated knowledge base with special interest in geo-referencing the data.

Approach

A systematic library review of the OCSEAP data that resides in the Archive section of the Rasmuson Library as well as in other department and institute libraries was done. The NOAA/MMS/ OCSEAP Comprehensive Bibliography was used to aid in discovering and locating data and establishing upper-level cross referencing terms for the knowledge base. Assistance from the Archivist and the environmental contaminants Reference Librarian of the Rasmuson Library, the Geophysical Institute Librarian and the Director of the Library at the University of Alaska Anchorage was invaluable in locating material and defining referencing terminology. A review of the CDROM-based Alaska Marine Contaminants Database was also completed in terms of data available and integration features.

Analysis of the form of OCSEAP data for inclusion in a knowledge base is critical. Information as to type of data, for example, cartographic (hard copy and digital), tabular material (reports, spreadsheets, data input forms, etc.) and other types (files, aerial photographs, satellite data, photographs, etc.) is required. The data was also evaluated for such things as: identification of thematic groups of information, data gaps, readiness for automation, relationships among data types and possible flows between data, temporal dependence and data form.

Results and Accomplishments

The OCSEAP Comprehensive Bibliography references over 3900 reports of various types _ journal articles, thesis, proceedings, papers, graphics, circulars, presentations, etc.; published, unpublished, submitted. The titles are further cross-referenced by lease area: Beaufort Basin, Chukchi Basin, Norton Basin, Navarin Basin, St. George Basin, Bristol Bay, Aleutian Shelf, Lower Cook Inlet, Kodiak Shelf, and Northeast Gulf of Alaska Shelf. Within each geographic area, up to 17 general disciplines are used as key words. We narrowed these to 12 disciplines including: chemistry, oceanography, meteorology, biology, mammals, birds, fish, benthic, intertidal, plankton, microbiology and bio-effects. During OCSEAP, emphasis was placed on the Bristol Bay, Beaufort, Norton Sound and Chukchi areas and on studies related to mammals, fish, birds and oceanography. To further prioritize this volume of information, we focused on final reports. This reduced the investigation to approximately 1200 referenced reports. Since the reviews are quite time-intensive, we further prioritized by selecting the comprehensive "Final Reports of the Principal Investigators"; this reduced the total to approximately 70 reports, averaging about 680 pages each. We have reviewed nine Final Reports and are continuing this effort with a follow-on project.

We have established a preliminary data dictionary which specifies the nature of each data element to be included in the knowledge base. The failure of a knowledge base to maximize its utility over as large a user group as possible often arises out of an initial, highly restricted perception of the potential uses of the knowledge base. To minimize this possibility, the on-going work was

reviewed by participants at the AAAS Arcitc Science Conference, representatives of Native groups, and local, state and federal agencies.

This initial foray into the extensive research conducted under OCSEAP provided a basis for organizing and preparing the data for evaluation by the science group. Much work was done, in areas and on topics that now need the benefit of measurements made in the past. Key to the usefulness of the OCSEAP data is scientific review of the data itself and the methodologies used to collect, analyze and report the results. This validation of the data with today's criteria for acceptability is the next logical step.

Assuming much of the OCSEAP data passes current scientific scrutiny, the design and development of a hierarchical knowledge base management system that is independent of specific applications and integrates with other important on-going efforts should make this baseline information available to be shared across a spectrum of users. Prerequisite to monitoring change in the Arctic as recommended by the UNEP/GRID Arendal workshop, AMAP and IARPC is knowledge of the past; the OCSEAP collection has the potential to fill some of the past data gaps in the Alaskan Arctic area.

Results of this project are being incorporated into follow-on work - "Synthesizing and Assessing Contamination Data in Arctic Alaska". We are expanding the project into three major tasks: Data Synthesis which covers the integration of contamination data from past projects and knowledge base design and implementation, Observation/Monitoring which outlines procedures for capturing existing programs and studies and initiating an assessment of the adequacy and gaps in data, and Communications which describes methods of coordinating with users and providers as well as releasing information.

Applications to the Arctic Radioactive Waste Assessment Problem

The current project is designed to discover usable baseline information against which current measurements of radionuclides as well as other contaminants in the Arctic may be compared.

Statistical Information

Publications

George, S.; K. Nance; and O. Parsons. 1996. "Development of a Prototype Georeferenced Knowledge Base for Monitoring and Assessing Contaminants in Arctic Alaska." Proceedings of the American Society for Photogrammetry and Remote Sensing, Alaska Region Annual Surveying and Mapping Conference.

George, S., S. Hills, K. Nance, C. Packett, O. Parsons and G. Weller. 1997. "Synthesizing and Assessing Arctic Contamination Data." The AMAP Symposium on Environmental Pollution in the Arctic., p. 288.

Nance, K.;O. Parsons; and S. Hills. 1996. "SynCon - A System for Synthesizing and Assessing Arctic Contamination Data." Proceedings of the International Conference on Circumpolar Health.

Nance, K. (1997a) "Applying AI Techniques in Developing Plans for Formerly Used Defense Sites (FUDS)" Journal of Mathematical Modeling and Scientific Computing, Vol. 8. (In Press)

Nance, K. (1997b) "Synthesis of Heterogeneous Data Sets" Proceedings of the 9th Annual Software Technology Conference.

Nance, K. (1997c) "Decision Support for Data Mining" Proceedings of the SCS 1997 Simulation Multiconference. 1997.

Nance, K. (1997d) " Developing Decision Support Tools for Environmental Data Organization." 1997. (In Press)

Parsons, O. "SynCon - A System for Synthesizing and Assessing Arctic Contamination Data." Department of Mathematical Sciences Technical Report 97-01. 1997.

Graduate students

Ms. Olga Proshutinsky Parsons, graduate student in the Department of Mathematical Sciences working towards a Master's degree in Computer Science. A Mentoring Program for Native American Students at UAF will be used to actively include Alaskan Natives in this work. An undergraduate student will be available to assist with data discovery.

Presentations

- American Society for Photogrammetry and Remote Sensing, Alaska Region. Annual Surveying and Mapping Conference, Anchorage, Alaska. February 6 - 9, 1996.
- Tenth International Congress on Circumpolar Health. Anchorage, Alaska. May 20 - 24, 1996.
- American Association for the Advancement of Science (AAAS), 47th AAAS Arctic Division Science Conference, Girdwood, Alaska. September 19 -21, 1996.
- AMAP International Symposium on Environmental Pollution of the Arctic, Tromso, Norway. June 1 - 5, 1997.

Arctic Contamination Research and Assessment

Glenn E. Shaw
Richard Benner
Geophysical Institute
University of Alaska
Fairbanks, AK 99775-0800

Introduction

The atmosphere of the Arctic is charged with gaseous and particulate material, mostly of industrial origin during the winter and spring months. Assessing the health and environmental impacts of this phenomenon, known as Arctic Haze, in the U. S. Arctic regions represents the long term goal of this research project.

The haze is primarily sulfate, but it also contains industrial signatures of trace heavy metals which have been used to establish source origins. Based on inventories of such tracers, it has been estimated that industrial sources in Eurasia contribute approximately 80 percent of the Arctic Haze, while sources in the northeastern United States make up most of the remaining fraction.

Arctic haze contains a minor fraction of black carbon or soot in the form of submicron particles that strongly absorbs sunlight. Sulfate particles, which make up the majority of the haze are concentrated by mass and area in a sub micron "accumulation" mode, which also interacts strongly with sunlight through scattering of electromagnetic energy. When placed over the reflecting polar ice, the haze introduces a positive radiative forcing into the earth-atmosphere, tending to warm the system. This radiative forcing is strongest in the spring months around the time of the vernal equinox when the sun rises and acts to photochemically convert large amounts of sulfur dioxide to the sulfate particles.

The "haze" builds up to a maximum under the photochemical conversion of SO_2 in late March and early April, then goes into declination as summer approaches. The industrial signatures are absent in the summer months. We do not understand exactly why this happens, but it is surmised that greater convective activity and cloudiness are responsible for removing the submicron particles from the atmosphere. They probably are removed most efficiently by serving as nuclei for water droplets in precipitating clouds.

It is impossible to forecast very accurately the future trends in the Arctic Haze since, on the one hand, Russian industry is starting to develop and implement industrial clean up technologies, but on the other hand, industrialization is expanding in northern Russia. The present economic situation does not bode well for large expenditures of revenues for improvements in air quality.

Our long term goal is to establish a chemical climatology for Arctic Haze and other pollution that may affect the atmosphere of the U.S. Arctic regions. We strive not only to establish benchmarks for the chemical climatology, but search for trends.

The objective of this task is intended to enhance existing contaminants monitoring programs in order to quantitatively establish the status and extent of contaminants in Arctic Alaska. We are implementing a modest expansion of monitoring activities associated with the NOAA facility at Barrow and extending into regions not presently covered.

We are setting up four high volume atmospheric sampling stations to collect aerosols for later chemical analysis. The stations are located at Barrow, in conjunction with the NOAA CMDL air monitoring facility; at the Poker Flat Rocket Range, 20 miles north of Fairbanks; at Homer, Alaska on a cliff overlooking the Gulf of Alaska; and at Eagle in eastern Alaska next to the Yukon River.

The filters will eventually be analyzed for trace metals, sulfate concentration and, in some instances, analyzed for radioisotopes.

Results and Accomplishments:

At each of the four stations, the sampling system used is similar to the one developed for the PACDEX experiments by Joseph Prospero of the University of Miami and Kenneth Rahn of the University of Rhode Islands. The aerosols are collected on Whatman #40 ultraclean filter paper at a nominal flowrate of 1050 liters per minute. Filters are changed twice weekly by technicians that we have trained at our laboratory, sealed in plastic bags and mailed to our laboratory. The pumps used are Roytron units, with excellent records of operation (we have run one such pump for nearly 10 years in another experiment in Alaska). These pumps have brushless motors and the exhaust, which may carry slight traces of heavy metals from bearing wear, is let out some 10 meters downstream from the mean wind direction.

Occasional blank filters are taken, by placing them on the holder, removing them and treating them exactly as the exposed filters to establish background contamination.

In addition to constructing and setting up the sampling stations and training the technicians who operate it, we have carried out some exploratory measurements at the Poker Flat Rocket Range site and at the Homer Site to determine the meteorological characteristics of the stations and to identify and quantify possible local sources of contamination.

The study at Homer showed that the site is quite clean, though there are occasional puffs of sub micron pollutants that affect the station, probably from traffic in the vicinity when winds are blowing from land to sea. We may install a sector controlled wind sampling system to avoid such contamination.

At Poker Flat, carbon monoxide, nitrogen dioxide, condensation nuclei and black carbon (soot particles) were monitored in real time and a large number of aerosol size distributions were carried out. We saw large differences in the concentrations of the compounds during times when air was entering interior Alaska from the Arctic, in comparison to times when airflow was coming from the Pacific Marine area to the south or west of Alaska. The Arctic air masses were strongly contaminated in comparison to the Pacific Marine, the concentrations of markers such as black carbon, nitrogen dioxide, carbon monoxide and accumulation mode aerosols all quite elevated.

We are finding evidence for production of new particles, apparently by homogeneous nucleation of sulfur bearing gases in the spring months. Though the data are still under analysis, this is quite an exciting discovery and may lead new light on the sources of aerosol particles in the atmosphere.

Applications to the Arctic Radioactive Waste Assessment problem

We are mailing filters occasionally, not regularly, to Dr. Baskaran at the analytical laboratory of Texas A and M University. He measures background gamma and alpha emissions on the filters and also determines the concentration of lead 210 and beryllium 7. We are trying to determine the age of the aerosols from the radio-isotope measurements and verify that the mean age decreases in spring as new particles are possibly being produced from the phtolytic conversion of sulfur dioxide to sulfate.

In the event of a radioactive release in Russia, we would begin to screen all filters for radioisotopes with our gamma ray system at the University of Alaska Fairbanks, which is now set up temporarily at the Institute of Marine Science.

Statistical Information

Publications

There are no formal publications to date; however, much of this work is reported in *Arctic Polution Issues,* the 1997 Arctic Monitoring and Assessment Programme report.

Graduate students

We are using the part time services of two graduate students, Will Cantrell and Dave Veazy.

Russian participation

Dr. Leonid Yurganov from St Petersburg is working with Dan Jaffe and he participated in experiments at Poker Flat by measuring total column amount of carbon monoxide. Though Yurganov is supported by another grant, his work ties in very well and has been instrumental in showing that the Arctic air masses are indeed contaminated, even when the entire atmospheric column abundance's are interrogated.

Persistent Organic Pollutant (POP's) Monitoring in Alaska

Daniel Jaffe
Geophysical Institute and Department of Chemistry
University of Alaska Fairbanks
Fairbanks, Alaska 99775.

Introduction

A small number of measurements in the Bering Sea and Canada suggest that persistent organic pollutants, such as pesticides and PCB's, are transported to the Arctic from distant sources. These pollutants may accumulate in the food chain and have consequences for ecosystems and inhabitants dependent on these ecosystems [e.g. Kinloch et al., 1992]. Currently there is no on-going monitoring of these pollutants within the state of Alaska or adjacent waters. The long term goals for this project are: (1) to develop the technical capabilities to measure the most critical compounds; (2) to identify transport pathways and sources for these compounds; and, (3) to develop an assessment of the ecological and human impacts.

The specific objectives for this project are:
1) Develop methodologies for measuring the most important persistent organic pollutants, including PCB's and toxaphene;
2) Make a series of measurements of these compounds inAlaska; and
3) Interpret the results with atmospheric back-trajectories.

The initial phase of this work was a literature review to determine the most appropriate measurement techniques to use for these compounds at the expected low levels. Once this was done equipment was assembled for measurements at Shemya and Fairbanks. Air samples were taken by pulling air through polyurethane foam (PUF) samplers. To date a small number of test samples have been collected and analyzed to evaluate the methodology. Atmospheric back trajectories are also being calculated for these periods. Initially it was expected that this would be a cooperative effort with the Alaska Department of Environmental Conservation (ADEC), however due to changes at the ADEC laboratory in Juneau this was not possible.

Results and Accomplishments

A small number of test samples were collected at Fairbanks and Shemya during the summer of 1995 to evaluate the methodology. These were analyzed by a commercial laboratory in Fairbanks (Northern Testing Laboratories, Inc.) using EPA method 8080. This is a GC-ECD technique which can identify and quantify pesticides, toxaphene, and PCB's. A "blank" was analyzed with the samples and no contamination problems found on the blank. The blank result indicates that the sampling and extraction procedures do not contaminate the samples during the sampling and analysis procedures. However the analysis of the real samples gave results which were much less than expected based on the small number of previous measurements collected in the Bering Sea. The table below shows the mean Fairbanks concentration of a number of PCB cogeners. For comparison, concentrations reported by Hinckley et al. [1992] in the Bering Sea are in the range of several hundred pg/m3 for these compounds. There are two possible explanations for this result. First, it is possible that the PUF sampling procedure used did not collect these compounds with 100% efficiency. The second possibility is that the samples were collected during a relatively clean summer period when transport to Alaska from industrial regions was reduced. We are exploring both possibilities, including laboratory work and calculations of back trajectories for these periods, which will help identify the source regions when these samples were collected.

Fairbanks sample -6.29.95-7.06.95- PCB cogenerconcentrations

	Air concentration (picograms/m3)
Aroclor 1016	<85.
Aroclor 1221	<85
Aroclor 1232	<85
Aroclor 1242	<56
Aroclor 1248	<56
Aroclor 1254	<56
Aroclor 1260	<56

These samples were collected during summer, and therefore not likely to exhibit the high concentrations found in winter-spring atmospheric samples. Because of the high price of conducting these analyses and the limits of our funding, no further sampling was conducted. Instead most of our effort was put into developing atmospheric trajectory modeling tools for Alaskan sites.

Data from this project will be available to the Arctic Monitoring and Assessment Program (AMAP).

References

Kinloch K., Kuhnlein H., and Muir D.C.G. Inuit foods and diet: a preliminary assessment of benefits and risks. The Science of the Total Environment 122, 247-278, 1992.

Hinckley D.A., Bidleman T.F., and Rice C.P. Long Range Transport of Atmospheric Organochlorine Pollutants and Air-Sea Exchange of Hexachlorocyclohexane. In: Results of the first Joint US-USSR Central Pacific Expedition (BERPAC). U.S. Fish and Wildlife Service, 1992.

Statistical Information

Publications

Atmospheric trajectory calculations for Shemya, Alaska are reported in: Jaffe, D.A., L.N. Yurganov, E. Pullman, J. Reuter, A. Mahura, and P.C. Novelli. Measurements of CO and O_3 at Shemya, alaska. *J. Geophys. Res.*, In press, July 1997.

Graduate students: 1.5

A Russian graduate student has been employed for the atmospheric back trajectory calculations.

Alaska Native Marine Science Intern Program at the School Of Fisheries And Ocean Sciences

University Of Alaska Fairbanks
John J. Kelley
Institute of Marine Science
School of Fisheries and Ocean Sciences
University of Alaska Fairbanks
Fairbanks, Alaska 99775

Introduction

The Institute of Marine Science (IMS) in the School of Fisheries and Ocean Sciences (SFOS) at the University of Alaska Fairbanks has conducted an internship program for the past decade with the primary goal of significantly increasing the number of Native (Alaska Indian and Eskimo) undergraduate students graduating with degrees in Science, Engineering and Mathematics (SEM). This program is strongly associated with other university support programs for Alaska Native Students (Figure 1).

The objectives of this Alaska Native Undergraduate Student Internship Program are:

- Involve Alaska Native undergraduate students in scientific research activities to increase their retention and success in pursuing a scientific career.
- Encourage pursuit of a graduate degree.
- Promote more effective communication of the results of scientific research, especially within the rural communities of the U.S. Arctic.
- Develop partnerships with agencies, industry and tribal councils.

This research was accomplished in part with support from the Arctic Contaminants and Research Project, U.S. Navy/Office of Naval Research. This report was presented at the Arctic Nuclear Waste Conference, Snow mass, Utah, May 1996 and at The Oceanographic Society annual meeting in Seattle, April 1996. The results of this project led to the establishment a radiation/climate monitoring program, NEWNET, in Alaska currently sponsored by the U.S. Department of Energy, Battelle Pacific Northwest National Laboratory.

Methods

The program consists of the following strategies:

Work/Study: (Nurturing through mentors) Students are selected for their interest and aptitude in pursuing an undergraduate degree (or higher degree) in (SEM). They are assigned to a volunteer participating faculty mentor who engages them in the activities of his/her laboratory. Students are required to write reports relating to any projects they carry out.

Seminars: (Application of college skills) A series of monthly seminars are conducted. The objective is to introduce the student to a contemporary science and engineering related problems and different points of view. The theme during 1995-96 is - Effective Communication of Scientific Results to the Public.

Field Experience: (Learning by doing) Interns participate in UAF Marine laboratory and shipboard short courses. Interns also gain experience during the summer by joining field parties of other agencies and institutions.

Establish Strong Support Group: (AISES nurturing leadership) All of our interns have access to the on-campus Rural Student Services (RSS) which provides a base for recruitment, social and learning activities. It facilitates transition from the village to university life. Our program actively supports the American Indian Science and Engineering Society (AISES) which provides strong leadership direction and national interaction.

Partnership: Develop cooperative projects with federal and state agencies, regional and village corporations and tribal councils to extend the training and support of the interns and to serve as a basis for potential future employment.

Results

- 67% of Alaska's 550,043 persons (1990 Census) live in the Fairbanks, Juneau and greater Anchorage areas.
- 70% of the State's 85,698 Alaska Natives live in over 200 small, remote villages.
- Alaska Natives make up 16% of the State's population.
- Of the 106 baccalaureate-seeking, full-time freshmen Native Americans who entered UAF in 1988, only 18.9% "persisted" after six years and 6.6% had graduated in 1994. UAF's overall record for that period showed 559 freshmen entering in 1988, 36.1% persisting for six years, and 25.8% graduating.
- During the last decade (1985-1995), a total of 51 students were involved in the IMS/SFOS intern program.
- 17 are still students.
- 14 are majoring in SEM fields.
- At the end of summer semester 1995, 18 (35%) had graduated and 4 had gone on to graduate school.
- Of the 18 graduates, 10 graduated in SEM, 4 in Education, 2 in Justice and 1 in Business Administration.
- 12 left school during this period and have not yet returned.
- Compared to the 81.8% drop-out rate, and 6.6% graduation rate for Alaska Natives at the UAF, the graduation rate for students who have been interns in this program is nearly 6 times greater than the UAF norm, and the drop-out rate is about one third.

Conclusions

- The transition from village life to a mainstream academic institution is a difficult one for Native students especially for those with an interest in SEM.
- Recruitment is just one step. There are several steps between recruitment and graduation, including a need for mentors, guidance and financial aid.
- This program integrates work/study experience through faculty mentors with community and peer group activities and financial support to promote good scholarship and academic success.
- Follow-up with postgraduates has yielded additional opportunities for interaction with interns.

Support

Support was provided by the National Science Foundation/Ocean Sciences; U.S. Navy/Office of Naval Research, and University of Alaska Fairbanks.

ALASKA NATIVE MARINE SCIENCE INTERN PROGRAM COLLABORATORS

3 & 4 years high school

NATIVE STUDENT CANDIDATES

HIGH SCHOOL

UPWARD BOUND PROGRAM

Rural Alaska Honors Institutes(RAHI)

STUDENT SUPPORT SERVICES
- Tutoring

RURAL STUDENT SERVICES (RSS)
- Provides "on-campus base for social and learning activities
- Facilitates transition from village environment to university life
- Provides academic advising and referral to other academic services such as the Alaska Native Marine Science Intern Program

ALASKA NATIVE STUDIES PROGRAM
- Courses provide student with a keen awareness of scope, richness and variety of Alaska Native Cultural heritage

AMERICAN INDIAN SCIENCE & ENGINEERING SOCIETY (AISES)
- All interns are expected to become members of the AISES
- The Alaska Native Marine Science Intern Program collaborates with this program

ALASKA NATIVE MARINE SCIENCE INTERN PROGRAM
- Works closely with collaborators
- Provides science project, laboratory and field experience
- Nurturing experience through mentors
- Monthly seminar series on contemporary problems
- Collaborates on projects with other agencies and institutes
- Summer instruction program/at-sea experience
- Development of AMP program with Oregon State University and Western Washington State U.

CROSS CULTURAL COMMUNICATIONS PROGRAM
- Offers several courses designed to capitalize on the similarities of experience brought to the University of Alaska Native and rural subjects

ADVISORY GROUP
- Monthly meetings with Chancellor's Assistant for AA/EO , Alaska Marine Science Intern Program and other on-campus and off-campus groups interested in enhancement of Opportunities for minorities in SEM

1994-95 PARTNERSHIPS
- USFWS(GRADUATE ASSISTANTSHIP)
- USN/ONR (Undergraduate Program)
- SITKA TRIBAL COUNCIL(Undergrad training with Sheldon Jackson College
- UA PRESIDENTS SPECIAL FUND (short-term projects)
- UA PRESIDENTIAL SCHOLARSHIPS (funded)